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# FINAL REPORT ON WORKSHOPS TO SUPPORT GUATEMALA'S NATIONAL GREENHOUSE GAS INVENTORIES

## FOREST CARBON, MARKETS AND COMMUNITIES (FCMC) PROGRAM



JANUARY 2015

This publication was produced for review by the United States Agency for International Development. It was prepared by Tetra Tech.

The U.S. Agency for International Development (USAID) launched the Forest Carbon, Markets and Communities (FCMC) Program to provide its missions, partner governments, and local and international stakeholders with assistance in developing and implementing REDD+ initiatives. FCMC services include analysis, evaluation, tools, and guidance for program design support; training materials; and meeting and workshop development and facilitation that support U.S. Government contributions to international REDD+ architecture.

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COVER PHOTO: Opening ceremony of the Opening Workshop. From left to right: Ms. Teresa Robles, Environment Officer at USAID in Guatemala; Ms. Michelle Martínez Kelly, Minister of Environment and Natural Resources; Mr. José Luis Rivera, Coordinator of the Climate Change Unit at the Ministry of Environment and Natural Resources.

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# TABLE OF CONTENTS

<b>ACRONYMS AND ABBREVIATIONS .....</b>	<b>III</b>
<b>EXECUTIVE SUMMARY.....</b>	<b>V</b>
<b>1.0 INTRODUCTION .....</b>	<b>I</b>
1.1 PROJECT INCEPTION.....	I
1.2 POLITICAL AND LEGAL CONTEXT .....	2
<b>2.0 DESIGN AND CONTENT OF THE WORKSHOPS.....</b>	<b>4</b>
2.1 DEVELOPMENT OF THE WORKSHOP.....	5
2.2 SELECTION OF THE INSTRUCTORS.....	5
2.3 CONTENT OF THE WORKSHOPS.....	6
<b>3.0 RESULTS OF THE WORKSHOPS .....</b>	<b>13</b>
3.1 PARTICIPATION AND LEARNING .....	13
3.2 CHALLENGES, OPPORTUNITIES, AND NEXT STEPS FOR PRIORITY SECTORS.....	13
<b>4.0 RECOMMENDATIONS: ROADMAP.....</b>	<b>24</b>
4.1 KEY MESSAGES.....	24
4.2 ROADMAP .....	28
<b>APPENDIX 1. REPORTS FOR THE WORKSHOPS TO SUPPORT GUATEMALA'S NATIONAL GREENHOUSE GAS INVENTORIES.....</b>	<b>34</b>
<b>APPENDIX 2. BIOGRAPHIES OF THE INSTRUCTORS .....</b>	<b>35</b>
<b>APPENDIX 3. SOURCES FOR THE WORKSHOPS .....</b>	<b>38</b>

# ACRONYMS AND ABBREVIATIONS

AGEXPORT	Guatemalan Exporters' Association
ATPAE	Asociación de Técnicos y Profesionistas en Ahorro de Energía
BUR	Biennial Update Report
CDM	Clean Development Mechanism
CGE	Consultative Group of Experts on Non-Annex I National Communications
CNCG	Climate, Nature and Communities in Guatemala
CONAP	Consejo Nacional de Áreas Protegidas
CONCYT	National Council for Science and Technology
COP	Conferences of the Parties of the UNFCCC
EC-LEDS	Enhancing Capacity for Low Emissions Development Strategy
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Statistics Division of the FAO
FCMC	Forest Carbon, Markets and Communities Program
FCPF	Forest Carbon Partnership Facility
GoG	Government of Guatemala
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GPG	Good Practice Guidance
ICA	International Consultation and Analysis
ILO	International Labor Organization
INAB	Instituto Nacional de Bosques
INE	Instituto Nacional de Estadística Guatemala
INECC	National Institute of Ecology and Climate Change
IPCC	Intergovernmental Panel on Climate Change
LED	Low Emissions Development
LEDS	Low Emissions Development Strategy
LULUCF	Land Use and Land-Use Change and Forestry
MAGA	Ministerio de Agricultura, Ganadería y Alimentación

MAGHG	Monitoring and Assessment of Greenhouse Gas Emissions and Mitigation Potential in Agriculture
MARN	Ministerio de Ambiente y Recursos Naturales de Guatemala
MRV	Monitoring, Reporting and Verification
NAMAs	Nationally Appropriate Mitigation Actions
NGO	Nongovernmental Organization
WWTP	Wastewater Treatment Plants
REDD	Reducing Emissions from Deforestation and Forest Degradation
SAT	Superintendencia de Administración Tributaria
SCA	Colombian Environmental Accounting System
SEGEPLAN	Secretaría de Planificación y Programación de la Presidencia
TACCC	Transparency, Accuracy, Completeness, Comparability, Consistency
TFI	Task Force on National GHG Inventories
UCC	Climate Change Unit
UNFCCC	United Nations Framework Convention on Climate Change
USAID	United States Agency for International Development
WWF	World Wildlife Fund
WWTP	Wastewater treatment plants

# EXECUTIVE SUMMARY

This report presents the findings and action points arising from a series of workshops that took place between July and November 2014 to support Guatemala's National Greenhouse Gas (GHG) Inventories. The workshops were developed in the context of a Low Emissions Development Strategy (LEDS) in Guatemala, supported by the program Forest Carbon, Markets and Communities (FCMC) of the United States Agency for International Development (USAID).

The development of this series of workshops for training on GHG inventories in Guatemala emerged as a collaborative effort between the different entities of the Government of Guatemala (GoG), under the leadership of Ministry of Environment and Natural Resources (MARN, "Ministerio de Ambiente y Recursos Naturales de Guatemala" in Spanish), and with the technical support of FCMC and the Climate, Nature and Communities in Guatemala (CNCG) Program to strengthen capabilities to develop GHG inventories for the sectors required by the National Communications<sup>1</sup>—Energy; Industrial Processes; Agriculture; Land Use, Land-Use Change, and Forestry [LULUCF]; and Waste. The workshops took place in a political and legal context of national and international interrelated commitments for the development and documentation of GHG inventories, as well as to have one of the necessary tools for low emissions development (LED). As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Guatemala has committed to develop, periodically update, publish, and report to the Conference of the Parties (COP) these National Communications which include the GHG emission inventories. Furthermore, Guatemala has promulgated various planning and legal instruments that created climate change commitments for government entities. In particular, MARN is "responsible for the National GHG Inventory and the development of climate change scenarios" (Decree 7-2013, article 7). Thus, Guatemala and in particular, MARN, have climate change commitments on both national and international levels.

Based on this collaborative capacity building effort, the below are the six key messages to achieve national GHG emissions inventories that 1) meet requirements of the UNFCCC, which Guatemala has ratified; and 2) are a solid component of policies and actions within a Low Emissions Development Strategy (LEDS):

1. **Develop a participatory National GHG Inventory System.** The only way that the effort to develop national GHG inventories will be sustainable, even if financial resources are available to maintain a permanent working group, is with the participation of different sectors in different stages of the inventory process.
2. **Build effective and sustainable institutional arrangements.** Based on the above, it is essential to identify and build effective and sustainable institutional arrangements, and transition from the previous temporary and irregular arrangements to continuous work processes involving permanent national technical teams.

In the case of Guatemala, decentralizing tasks and inventories by sector seems preferable. Such a model would facilitate integrating tasks and inventories with sectoral mitigation policies. In this context, MARN would have the key role of compiling, coordinating, and ensuring methodological

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<sup>1</sup> Guatemala is a non-Annex I Party to the United Nations Framework Convention on Climate Change (UNFCCC). All Parties must submit national reports on implementation of the Convention to the Conference of the Parties (COP). The required contents of National Communications and the timetable for their submission are different for Annex I and non-Annex I Parties. This is in accordance with the principle of "common but differentiated responsibilities" enshrined in the Convention.

consistency in the inventories. In turn, each involved ministry or institution would provide their corresponding sectoral inventory to MARN, including activity data, emission factors, and calculation methodology. MARN would then carry out a quality check. At the same time, MARN would act as focal point to the UNFCCC and would liaise with the sources of funding and technical assistance to ensure that the ministries and sectoral institutes are able to implement REDD+<sup>2</sup>, Nationally Appropriate Mitigation Actions (NAMAs), and LEDS policies. This model is in line with MARN's vision of creating strong internal capabilities in addition to building capacity for its primary role as compiler, coordinator, and reviewer.

3. **Build stable technical capabilities within ministries and other government agencies already working on GHG inventories and aim to develop a National GHG Inventory System in Guatemala.** Within the suggested model, it is important that MARN have the capacity to lead and manage the entire process as well as control the quality of the inputs it receives from the sectoral institutions, e.g., technical capacity and ability to maintain a dialogue with all responsible institutions. It is necessary to strengthen the capacities of those contributing to inventory data and to develop data generation chains. These improved capabilities will allow the responsible agencies to prepare the inventories independently of MARN. MARN would then receive and validate the products but have limited involvement in sector inventories.
4. **Prioritize the strengthening of information.** In addition to strengthening the technical skills needed to develop inventories, it is imperative to put in place processes to improve the statistical data available in key sectors of the inventory where weaknesses have been identified. Inventories are a tool for the public and private sectors to use to make policy decisions. Decision-making requires information systems and adequate data quality.

Some categories or subsectors do not have complete or reliable activity data. A similar problem exists with respect to national emission factors, and the government has prioritized their development or validation.

It is advisable in this new phase to prioritize activity data, which are essential for domestic Monitoring, Reporting, and Verification (MRV). Inventories are instantaneous photographs of a dynamic reality in which the annual activity data generally changes the most (for example, the number of cattle, hectares planted, deforested land area, wood consumption, fossil-fuel consumption, industrial production, waste generated, etc.). However, the emission factors tend to be more stable; if there are no national values, one can temporarily use the default Intergovernmental Panel on Climate Change (IPCC) factors, especially for non-critical categories. In other words, the development of MRV actions is largely associated with activity data, and MRV is a key element of LEDS, NAMAs, and REDD+.

5. **Prioritize the completion and submission of the first Biennial Update Report (BUR) (for example during the first quarter of 2015) based on the 2010 inventory.** It would be highly advantageous for Guatemala to be among the countries that send their first BUR in late 2014 and early 2015, and therefore form part of the International Consultation and Analysis (ICA) process of the UNFCCC. The ICA begins operating in 2015 to analyze inventories of non-Annex I countries and to provide recommendations for continuous improvement. Eventually, Guatemala could consider providing its BUR with the Second National Communication. Alternatively, it could deliver this communication later if the delay in the BUR jeopardizes their entrance in the first round of the ICA process.

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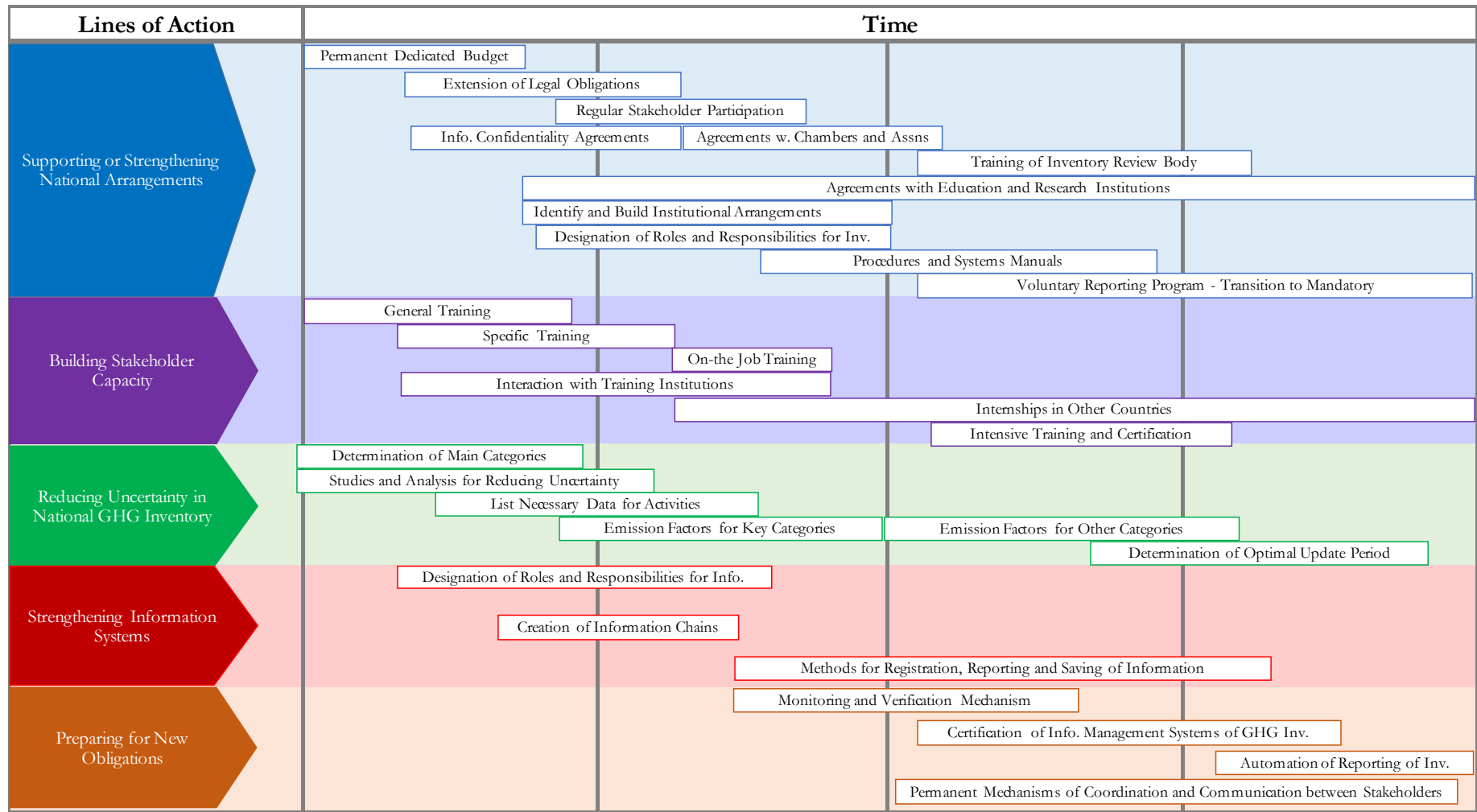
<sup>2</sup> Reducing Emissions from Deforestation and Forest Degradation. "REDD+" goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.



6. **Common aspects with LEDS.** The analysis, effort, training, and vision that have been used in this series of workshops is fully consistent with the vision of LEDS. Thus, it would be appropriate to reconsider some of the points made in this report and, if required, reinforce some of them to give continuity to the support that is ending with this consultancy. Several of the recommendations and key messages are applicable for LEDS and can serve as additional input for planning and developing activities, particularly in the initial stages.

To address the above key messages, Figure I presents a suggested roadmap that is further developed in the remainder of this report. Activities in development or resulting from the implementation of LEDS that could be part of this general emissions management roadmap are not included, since the focus of these workshops was the national and sectoral GHG inventories.

**FIGURE I: PROPOSED ROADMAP FOR THE NATIONAL GHG INVENTORIES SYSTEM IN GUATEMALA**



# 1.0 INTRODUCTION

The development of these workshops for training on GHG inventories in Guatemala emerges as a collaborative effort between the different entities of the Government of Guatemala (GoG), under the leadership of MARN, and with the technical support of FCMC and CNCG to strengthen the capabilities for the development of GHG inventories for the sectors required by the National Communications (section 1.1). The workshops took place in a political and legal context of national and international interrelated commitments for the development and documentation of GHG inventories, as well as to have one of the necessary tools for a low emissions development (LED, section 1.2). As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Guatemala has committed to develop, periodically update, publish, and report to the Conference of the Parties (COP) these National Communications which include the GHG emission inventories. Furthermore, Guatemala has promulgated various planning and legal instruments that created climate change commitments for government entities.

## 1.1 PROJECT INCEPTION

In March 2013, USAID hired a multidisciplinary team of FCMC sector experts to evaluate the existing and needed elements for the preparation of a LEDS in Guatemala. LEDS is a strategy that aims to ensure reduced emissions while supporting economic growth. This work was carried out within the framework of Enhancing Capacity for LEDS (EC-LEDS).

As part of this work, the FCMC team analyzed the institutional capacity of MARN and the Presidential Secretariat of Planning and Programming (SEGEPLAN, “Secretaría de Planificación y Programación de la Presidencia” in Spanish) to lead a LEDS from a technical and planning perspective respectively. The FCMC team also reviewed the GHG inventories in the draft Second National Communication to UNFCCC and assessed the methodologies used at the macro level. Finally, for the sectors required in the National Communications (Energy; Industrial Processes; Agriculture; Land Use, Land-Use Change and Forestry or LULUCF; and Waste) the team identified options for improvement of the inventories and key mitigation opportunities. The team proposed steps to develop an action plan for each sector. The experts complemented their analysis with high-level meetings with entities of the GoG, the private

### FOREST CARBON, MARKETS AND COMMUNITIES PROGRAM (FCMC)

USAID launched the FCMC Program, which offers assistance for the integral management of natural resources that: a) reduce the causes of deforestation; and b) promote sustainable production in deforested or degraded areas. FCMC can assist countries that seek to reduce emissions caused by use of land, and supports USAID delegations that implement the United States Government Program to Enhance Capacity for LEDS.

*Source: FCMC Fact sheet, USAID.*

### CLIMATE, NATURE AND COMMUNITIES IN GUATEMALA (CNCG) PROGRAM

This USAID initiative supports Guatemala. The project will be implemented by a consortium of environmental, academic, and business institutions led by the international conservation organization the Rainforest Alliance, together with Fundación Defensores de la Naturaleza, Universidad del Valle de Guatemala, the Guatemalan Exporters’ Association (AGEXPORT), The Nature Conservancy, and the World Wildlife Fund (WWF).

*Source: Rainforest Alliance Press Release. July 23, 2013.*

sector, academics, and technical government staff responsible for the implementation of climate change initiatives in the country (Tetra Tech, 2013).

One of the key results of this work was the identification of capacity building needs in developing GHG inventories for the sectors required in the National Communications. The development of workshops on GHG inventories in Guatemala stems from this identification, as a collaborative effort between the different entities of the GoG, under the leadership of MARN, and with the technical support of the FCMC and the CNCG programs. It targets the different relevant actors involved in the development of sector GHG inventories.

## **1.2 POLITICAL AND LEGAL CONTEXT**

After ratifying the UNFCCC and becoming a signatory of the Kyoto Protocol in 1998, Guatemala officially launched climate change activities within the framework of “common but differentiated responsibilities” enshrined in the UNFCCC with the First National Communication and Action Plan on Climate Change.

As a Party to the UNFCCC, Guatemala is committed to develop, periodically update, publish, and report to the Conference of the Parties (COP) in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol, as well as other precursor gases of climate change, using comparable methodologies agreed upon by the COP. As a non-Annex I country in the Convention and as established at COP 17, Guatemala must submit its first BUR in December 2014.<sup>3</sup> The BUR will be presented every two years, once alone and once with the National Communication, which is submitted every four years.

The BUR is a document that contains a description of national circumstances and institutional arrangements; an updated version of the inventory; mitigation actions and their effects (including description of methodologies and assumptions used); the identification of constraints and gaps as well as the technical and financial cooperation needed; the level of support received to prepare the BUR; and a description of the domestic arrangements for the system of MRV.

Furthermore, the COP 16 (Cancun 2010) decided to improve the quality of reporting of GHG inventories for all countries and conduct an ICA of the BUR for developing countries. The decisions of the COP 16 and COP 17 represent an important change to the reporting systems with respect to those in force up until now, given that developing countries were sending information infrequently, and this information was not reviewed. The new system combines more frequent reports with a broader scope (BUR) and international verification (ICA) to improve the quality and completeness of the information reported, while building confidence and helping to increase levels of ambition of the mitigation actions in the context of sustainable development. Therefore, meeting the requirements in the new international legal framework represents new challenges for the GoG, which should be properly internalized.

To meet its obligations as a signatory to the UNFCCC and combat the adverse effects of climate change, Guatemala created the Climate Change Unit (UCC, “Unidad de Cambio Climático” in Spanish), attached to the Directorate General of Environmental and Natural Resources Management under MARN’s Vice Ministry of Environment.

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<sup>3</sup> Note that an early delivery in 2015 would also be appropriate and allow Guatemala to benefit from entering the centralized review process that the UNFCCC will begin implementing in 2015.

The GoG also issued and promulgated various planning and legal instruments, prominently the National Climate Change Program (2003, “Programa Nacional de Cambio Climático” in Spanish) and the Framework Law to Regulate the Reduction of Vulnerability, Compulsory Adaptation to the Effects of Climate Change and Mitigation of Greenhouse Gases (“the Law”, “Ley Marco para Regular la Reducción de la Vulnerabilidad, la Adaptación Obligatoria ante los Efectos del Cambio Climático y la Mitigación de Gases de Efecto Invernadero” in Spanish) according to Congressional Decree 7-2013. Specifically, the Law stipulates in Article 7 that MARN “must strengthen its institutional capabilities for research, measurement and monitoring of emissions of greenhouse gases -GHG- and other aspects associated with climate change, and must also be responsible for the National GHG Inventory and the development of climate change scenarios.” Thus, Guatemala and in particular, MARN, have climate change commitments on both national and international levels

Within this context, the workshops carried out in 2014 focused on creating capacities within the relevant institutions to develop and document GHG inventories, which are the fundamental basis to meeting domestic and international commitments in response to climate change, as well as to having one of the key tools for a LEDS (including MRV).

## 2.0 DESIGN AND CONTENT OF THE WORKSHOPS

FCMC's work consisted of four workshops: an opening workshop, two workshops focused on the LULUCF and Agriculture Sectors, and a closing workshop. These four workshops were an integral part of a total of seven workshops, since to complement the work under FCMC, CNCG funded three additional workshops in the Energy, Industrial Processes, and Waste sectors.<sup>4</sup>

All workshops were designed with consistent objectives and similar formats. In addition, MARN supported the development of the content and agenda of each of the seven workshops. MARN convened the entities that were directly or indirectly involved in the development of inventories. Finally, the World Wildlife Fund (WWF), one of the implementing organizations of the CNCG Program, handled the logistical aspects of the seven workshops, ensuring that there was consistency and optimal integration in the implementation of all workshops.

Table I shows the different programs and institutions involved in the implementation of the workshops, and it highlights the workshops that FCMC supported directly.

**TABLE I: SUPPORT BY INSTITUTIONS AND PROGRAMS FOR THE WORKSHOPS**

WORKSHOP	DATE (2014)	FUNDING	LOGISTICS	CONVENING
Opening	25-26 July	FCMC	WWF/CNCG	MARN
LULUCF	7-8 August	FCMC	WWF/CNCG	MARN
Energy	26-27 August	CNCG	WWF/CNCG	MARN
Agriculture	10-11 September	FCMC	WWF/CNCG	MARN
Industrial Processes	14 October	CNCG	WWF/CNCG	MARN
Solid Waste	15-16 October	CNCG	WWF/CNCG	MARN
Closing	20 November	FCMC	WWF/CNCG	MARN

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<sup>4</sup> Even though CNCG financed three workshops (Energy, Industrial Processes, and Waste), the results of all seven workshops are included in this report to give a complete overview of the work on GHG inventories in Guatemala.

## 2.1 DEVELOPMENT OF THE WORKSHOP

The agendas were developed through an iterative process between FCMC consultants, representatives of CNCG, MARN, and ministries responsible for the sector in question. Also, assessments and feedback of each workshop resulted in adjustments to subsequent workshops. Moreover, MARN led the outreach and invitations for each workshop, which—in addition to the support of FCMC, CNCG, and USAID, among others—resulted in a convening power that brought together the majority of relevant organizations working in the priority sectors in Guatemala.

Separate from this report we prepared a detailed report (Appendix I) for each workshop, describing its development, references to supporting materials, list of participants, surveys and tests applied to the participants, and comments and conclusions of the instructors.

## 2.2 SELECTION OF THE INSTRUCTORS

The instructors of the workshops were selected based on the following criteria:

- Detailed knowledge of the methodologies of the IPCC for inventories, and experience in the application of these methodologies
- Experience in developing GHG inventories in the sector of interest
- Experience in training and facilitating capacity building workshops
- Experience in developing GHG inventories in countries outside of Guatemala

The following experts were selected for the workshops because they met all requirements. In addition, the instructors could be more effective, since as the development of the workshops progressed, so did their understanding on the data situation and capabilities in Guatemala. Appendix 2 presents the biographies of the instructors.

**TABLE 2: INSTRUCTORS FOR THE WORKSHOPS**

WORKSHOP	INSTRUCTORS
Opening	Julia Martínez, Walter Oyhančabal, Mark Oven
LULUCF	Walter Oyhančabal, Benjamin Caldwell
Energy	Ignacio Barutta, Jorge Alberto Plauchú
Agriculture	Walter Oyhančabal, Francisco Luis Aviña Cervantes
Industrial Processes	Ignacio Barutta, Jorge Alberto Plauchú
Solid Waste	Ignacio Barutta, Jorge Alberto Plauchú
Closing	Jorge Alberto Plauchú, Julia Martínez, Walter Oyhančabal, Mark Oven

## 2.3 CONTENT OF THE WORKSHOPS

The workshops were designed as a whole to strengthen a government platform for the development of GHG inventories in Guatemala. The format of the workshops consisted of presentations<sup>5</sup> by experts to representatives of organizations of all stages and skills, collaborating or that will potentially collaborate in the implementation of national GHG inventories of the different sectors. These participants included staff from ministries and government, academic and research institutes, organizations that contribute or will contribute relevant data to develop the inventories, businesses that generate GHG emissions to be reported for the priority sectors, and technical consultants and representatives of international cooperation agencies that provide resources for institutional strengthening in related activities. The results of each workshop were reflected in reports submitted to MARN after each workshop (Appendix I).

The applicable methodologies for calculating inventories and the one used in workshops, are the IPCC guidelines for national GHG inventories (revised in 1996); the IPCC's Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (2000); and the Good Practice Guidance for LULUCF (2003)<sup>6</sup>. Guatemala, a non-Annex I country, must use these documents as a basis for developing inventories according to decision 2/CP.17 of the UNFCCC.<sup>7</sup>

In addition, the instructors used teaching materials developed by the Consultative Group of Experts on National Communications from non-Annex I countries (CGE) of the UNFCCC, available at [http://unfccc.int/national\\_reports/non-annex\\_i\\_natcom/cge/items/2608.php](http://unfccc.int/national_reports/non-annex_i_natcom/cge/items/2608.php); and UNFCCC guides and manuals on reporting processes of GHG inventories and BUR available at [http://unfccc.int/national\\_reports/non-annex\\_i\\_natcom/guidelines\\_and\\_user\\_manual/items/2607.php](http://unfccc.int/national_reports/non-annex_i_natcom/guidelines_and_user_manual/items/2607.php).

### 2.3.1 Opening Workshop

The Opening Workshop introduced participants to the broader issues of GHG inventories. It also laid out the foundation for the subsequent sectoral workshops.

The Opening Workshop emphasized the link between GHG inventories in the National Communications framework to UNFCCC, the National Mitigation Plan, and the development of LEDS. This effort began in 2013 with the first technical assistance from FCMC to help clarify the link between inventories and LED policies, and to emphasize the importance of inventories to establish baselines and baseline scenarios that allow for estimating the impact of mitigation actions, policies, and programs in Guatemala. The Opening Workshop also highlighted that all signatories to the UNFCCC are required to identify and quantify mitigation policies in some way, e.g., through instruments such as NAMAs. Given these interrelated issues, the Opening Workshop—and, in more depth, the sectoral workshops—established a close relationship between having a high quality inventory, establishing baselines, identifying LED policies, and having a portfolio of NAMAs that Guatemala can present to different funding sources, such as the Green Climate Fund.

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<sup>5</sup> These presentations are available for download at:  
[https://www.dropbox.com/sh/cohnv3510e6orj2/AAB8Za3IbG0IbJ0vOO0E\\_1LRa?dl=0](https://www.dropbox.com/sh/cohnv3510e6orj2/AAB8Za3IbG0IbJ0vOO0E_1LRa?dl=0)

<sup>6</sup> This guidance is available at: <http://www.ipcc-nggip.iges.or.jp>

<sup>7</sup> Guatemala, as a non-Annex I country, cannot universally use the 2006 revised IPCC methodologies.



For the inventories, the Opening Workshop presented:

- the characteristics, structure, and general content of GHG inventories;
- the five basic requirements of an inventory: Transparency, Accuracy, Completeness, Comparability, Consistency (TACCC);
- the main IPCC methodologies of estimation according to type of source and sink, and the IPCC best practices to continuously improve the national inventories so that they are increasingly more TACCC; and
- the inventory as a tool for the design and implementation of mitigation policies.

The Opening Workshop therefore emphasized that inventories are not just a product of value in themselves, nor just a formal requirement under the UNFCCC, but rather a powerful tool for climate change mitigation policies and for obtaining international financing and technical cooperation.

The Opening Workshop sought to convey that that GHG inventories are essentially built from two main types of information: a) statistical data of activities (e.g., hectares deforested, amount of nitrogen fertilizer used, amount of fuel oil burned); and b) emission factors/removal. A weak statistical system thus represents a severe restriction for quality inventories.

Similarly, the Opening Workshop underlined the importance of prioritizing the sources of GHG emissions in Guatemala and the information provided by the main categories in the improvement plans. Accordingly, the focus of the workshops for each of the priority sectors was defined.

The Opening Workshop covered concepts, objectives, and benefits for developing a National GHG Inventory System—i.e., all institutional, legal, and procedural arrangements—in order to:

- estimate the anthropogenic emissions of GHG sources and removals by sinks;
- ensure transparency, accuracy, completeness, consistency, and comparability;
- ensure quality in the process of planning, preparation, and management of activities; and
- report and archive inventory information.

The new requirements on biennial reporting (BUR) suggested the almost inevitable need to develop national inventory systems, which ensure appropriate coordination of institutions called to participate directly or indirectly in the process.

Finally, examples of national inventory systems in developed (Finland) and developing (Chile) countries were presented. This section, considered very relevant, was prepared based on the latest UNFCCC materials—in particular the “Toolkit for non-Annex I Parties on establishing and maintaining institutional arrangements for preparing National Communications and biennial update reports,” which the UNFCCC published in 2013.

During the Opening Workshop, the instructors notified the participants that FCMC had worked with one of its partners, the Greenhouse Gas Management Institute (GHGMI) to develop and an online course in Spanish on “GHG Accounting for Forest and Other Land Use Projects.”<sup>8</sup> Through FCMC, five

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<sup>8</sup> [http://fcmcglobal.org/ghgmi\\_course.html](http://fcmcglobal.org/ghgmi_course.html)

Opening Workshop participants received scholarships of US\$375 each, and completed the online course over the following months.

### 2.3.2 Sectoral Workshops

The objective of the sectoral workshops was to provide practical and proven information on the methodologies, protocols, and rules for developing GHG inventories in each sector, applying IPCC's best practices.

The sources for the development of the content of the sectoral workshops were the methodological materials of the IPCC, according to decision 2/CP.17 of the UNFCCC. Each workshop included the details of the methodologies and instructions for their application, as well as practical exercises to perform calculations. The workshops combined didactic lectures, group exercises, and discussion. In addition, the instructors assigned readings to the participants prior to the workshop to facilitate and reinforce learning during the workshop (Table 3).

**TABLE 3: ASSIGNED READINGS AND GROUP EXERCISES**

WORKSHOP	READINGS ASSIGNED PRIOR TO THE WORKSHOP	GROUP EXERCISES
LULUCF	Revised 1996 IPCC Guidelines for National GHG Inventories: <ul style="list-style-type: none"> <li>Chapter 5</li> </ul> IPCC Good Practice Guidance (GPG) for LULUCF: <ul style="list-style-type: none"> <li>Chapter 3</li> </ul>	<ul style="list-style-type: none"> <li>Calculation of carbon stock changes in forests</li> <li>Consistent representation of land</li> <li>Working techniques with incomplete time series</li> </ul>
Energy	Revised 1996 IPCC Guidelines for National GHG Inventories: <ul style="list-style-type: none"> <li>Chapters 1, 2-1, 3-1</li> </ul> IPCC Good Practice Guidance and Uncertainty Management: <ul style="list-style-type: none"> <li>Chapters 1, 2, 6, 7, and 8</li> </ul>	<ul style="list-style-type: none"> <li>Construction of GHG emissions scenario "business as usual" in the Energy sector of Guatemala</li> <li>Calculation of emissions from stationary combustion and fugitive emissions</li> <li>Calculation of emissions from mobile combustion</li> <li>Construction of Energy national inventory from actual data for Guatemala, including development of emission factors for fuels with typical composition</li> </ul>

WORKSHOP	READINGS ASSIGNED PRIOR TO THE WORKSHOP	GROUP EXERCISES
Agriculture	Revised 1996 IPCC Guidelines for National GHG Inventories: <ul style="list-style-type: none"> <li>Chapters 4-1, 4-2, and 4-3</li> </ul>	<ul style="list-style-type: none"> <li>Calculation of methane emissions from livestock</li> <li>Calculation of nitrous oxide emissions from manure</li> <li>Analysis of opportunities and constraints for low carbon development in Agriculture, including ideas about the (technical and statistical) information that is available and unavailable, technologies, and good practices that could be promoted for producers and farmers to improve inventory figures</li> </ul>
Industrial Processes	Revised 1996 IPCC Guidelines for National GHG Inventories: <ul style="list-style-type: none"> <li>Chapters 1, 2-2, and 3-2</li> </ul> IPCC Good Practice Guidance and Uncertainty Management: <ul style="list-style-type: none"> <li>Chapters 1, 3, 6, 7, and 8</li> </ul>	<ul style="list-style-type: none"> <li>Basic GHG Calculations for National Communications for II categories and subcategories of industrial processes</li> </ul>
Waste	Revised 1996 IPCC Guidelines for National GHG Inventories: <ul style="list-style-type: none"> <li>Chapters 1, 2-6, and 3-6</li> </ul> IPCC Good Practice Guidance and Uncertainty Management: <ul style="list-style-type: none"> <li>Chapters 1, 5, 6, 7, and 8</li> </ul>	<ul style="list-style-type: none"> <li>Calculation and reporting of solid waste emissions</li> <li>Calculation and reporting of liquid waste emissions</li> <li>Construction of sectoral national inventory of waste from real data from other countries</li> </ul>

For each sectoral workshop, the sector experts took the following actions:

1. Reviewed the IPCC methodologies and best practices for the development of inventories in the areas of interest; identified source and support documents relevant to Guatemala, which were assigned for reading prior to the workshops; and prepared concise presentations in a predefined format
2. Presented and analyzed relevant examples of development of GHG inventories in the given sector, emphasizing the guidelines on best practices recommended by the IPCC
3. Divided participants into small groups to work on exercises designed to emphasize the application of estimation methodologies, and ensure that each participant applied these methods and became familiar with the IPCC guidance documents. The exercises were tailored to the reality of Guatemala in several important categories in the inventory, using activity data from Guatemala. The exercises covered a range of topics from specific calculations, e.g., the development of emission factors, to the synthetic construction of sector inventories based on Guatemala's actual data (Table 3).

4. Led questions and answers sessions, as well as other discussions to give participants better tools for developing GHG inventories. The instructors then used these exchanges in elaborating next steps for the development of GHG inventories in each sector in Guatemala (Chapter 3).

The sources used for the development of the content of the sectoral workshops as well as during these workshops are listed in Appendix 3 (this list includes those already presented).

### 2.3.3 Closing Workshop

The Closing Workshop summarized the workshops on GHG inventories of the previous five months. This workshop brought together the key instructors of the workshop series, took stock of local progress on the inventories, and presented the views of the instructors regarding next steps for the National GHG Emissions Inventory. In addition, small groups of participants were organized by sector to work together to provide additional recommendations from the perspectives of local practitioners.

The Closing Workshop was conducted in five parts, as listed below and described in the rest of this section. A detailed description of the covered topics can be found in the Closing Workshop Report:

- Advances in Guatemala's inventory system
- Results of the sectoral workshops on GHG inventories
- Key aspects of a GHG inventory system
- Lessons learned in the development of a national system for GHG inventories in Mexico
- Interactive group work
- USAID LEDS Program

#### **Advances in Guatemala's inventory system**

For this introductory module, Teresa Robles from USAID highlighted USAID's support for specific issues, based on good experiences to date, as a result of continued cooperation between the governments of the United States and Guatemala.

In addition, Ms. Michelle M. Martinez Kelly, Minister of Environment and Natural Resources of Guatemala, synthesized the international context, which imposed challenges, obligations, and opportunities for the country. She also presented the institutional framework, national vision, and current efforts. She concluded her presentation by thanking USAID for the support related to this series of workshops.

In his presentation Marcel Oseida, of MARN's UCC, emphasized the creation and strengthening of institutional and individual capacities toward the goal of national self-sufficiency in conducting national GHG inventories. Similarly, he outlined the need to strengthen the infrastructure of Guatemala's national system for GHG inventories in structural and material resources, in light of Guatemala's commitments as a signatory of the Kyoto Protocol as a non-Annex I country.

It is important to recognize that the development of National GHG Inventory should be a coordinated effort that occurs in stages, in which collaboration between private sector, government, institutions, consultants, and academia is required for maximum efficiency and minimum time not only in the preparation, but also in regular updates and verifications.

These remarks were framed in the context of the national climate change policy. One of the primary objectives of this policy is the integrated management of GHG emissions. Reliable information on GHG

inventories is fundamental for both the planning and the monitoring of the performance of mitigation programs and actions, in addition to being the main input for the BUR.

### **Results of the sectoral workshops on GHG inventories**

During this part of the presentation, Walter Oyhantçabal and Jorge A. Plauchú reviewed the workshops for the LULUCF, Agriculture, Energy, Industrial Processes, and Waste sectors. They summarized the topics covered, the national context in which each of the workshops was developed, the results of the participants' group work in each of the workshops, the improvements identified and discussed by the participants, lessons learned, support or actions necessary to streamline and improve the accuracy of the development national sectoral GHG inventories, and observations of the instructors.

### **Key aspects of a National GHG Inventory System**

Regarding the National GHG Inventory System, Mark Oven, Walter Oyhantçabal, and Jorge A. Plauchú highlighted the following items:

- The formal and functional characteristics of such systems, including the relationship between these inventories and elements of the biennial reports (BUR) and the National Communications to the UNFCCC
- The contextual framework of the GHG inventories from a functional perspective and as an input
- Typical institutional relations for national GHG inventories
- The elements of a system of national inventories and the interrelation between them
- The importance of national arrangements as background and guarantor of appropriate implementation of the national GHG inventories, as well as the roles and responsibilities of participants in developing GHG inventories
- The development cycle of national GHG inventories
- A suggested matrix of functions, activities, and responsibilities for the development of inventories
- Case studies of development and operation of national inventory systems in Chile and Finland
- The main barriers identified and discussed during the workshops, as well as some challenges and opportunities facing the future development of national GHG inventories in Guatemala.

Finally, the presenters highlighted the fact that national GHG emissions inventories are valuable if their quality allows them to be real management tools – as opposed to the product of an effort that arises from a reporting obligation.

Thus, the need to increase the accuracy and reliability of the National GHG Emissions Inventory is justified, covering comprehensively at least the main categories by sector and reducing the gap between the current situation and the ideal one in terms of the above aspects.

### **Lessons learned in the development of a national system for GHG inventories in Mexico**

In this module, Julia Martinez presented the lessons learned in Mexico in the context of national GHG inventories. She addressed in great depth the relations between the various actors involved, the barriers that had to be overcome, the activities of monitoring and optimization, and the institutional challenges that arose and still arise.

Ms. Martinez also presented on Mexico's experiences in establishing an iterative process to improve communications and build trust in relationships with the productive sector. This process was based on establishing direct relationships and mechanisms through which Mexico obtained better information for the inventories.

Another important point made was the interaction with international organizations and with authorities and organizations in other countries for training, validation, and generation of synergies, by integrating multinational teams virtually or through exchange programs.

Notably she proposed the possibility that staff involved in inventories' development activities in Guatemala could participate in internships or similar staff exchanges at the National Institute of Ecology and Climate Change (INECC, "Instituto Nacional de Ecología y Cambio Climático" in Spanish) through agreements between the governments of both nations.

### **Interactive group work**

During the interactive group work, questionnaires were presented to groups. These questionnaires focused on GHG inventories and LEDS for the priority sectors (LULUCF, Energy, Agriculture, and Waste)<sup>9</sup>. The objective of the questionnaires was to encourage the participants to express improvement areas, barriers, proposals for action and optimization, as well as their views on Guatemala's system of national inventories given the upcoming implementation of LEDS and the current country obligations in this regard.

Each questionnaire was designed in response to the points raised in the sectoral workshops, to give participants a greater level of detail and understanding.

The issues ranged from the description of opportunities, prioritization of technical improvement in activity data and emission factors, necessary or appropriate institutional arrangements, and the optimal form of participation of the relevant entities of the GoG and others in the development of GHG inventories and LEDS; to suggestions of support schemes of the various ministries for these issues, training needs, requirements or standards that are currently still in development for GHG inventories, and other points that each group considered important to note.<sup>10</sup>

### **USAID LEDS Program**

For the final module, Luis Castañeda, LEDS Program Director in Guatemala, explained in detail the characteristics, structure, and integration of the LEDS Program. He also reinforced the idea that the Program has a close connection with the development of GHG inventories and therefore considered it essential that sectoral workshops were conducted before other activities.

He also addressed the objectives of a LEDS and its integration within programs or sectors in the country. He said that the process of developing the detailed plan of activities starting in 2015 was underway.

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<sup>9</sup> A group for the Industrial Processes Sector was not formed because the representatives of the industrial sector did not participate in the Closing Workshop.

<sup>10</sup> The following section presents a summary of the results; however, more details can be found in the Closing Workshop Report.

## 3.0 RESULTS OF THE WORKSHOPS

The series of workshops was successful, judging by the high turnout in terms of both the number of participants and the number of entities represented in each workshop (see Section 3.1). The workshops also allowed an important exchange between participants and instructors, which resulted in the identification of challenges, opportunities, and next steps for each sector (see Section 3.2).

### 3.1 PARTICIPATION AND LEARNING

The series of workshops had a high turnout, both in terms of number of participants and number of entities represented in each of the workshops (Table 4). At the same time, the workshop evaluations and feedback from participants indicate that there was significant learning and that the participants appreciated the value of the workshop. Furthermore, the instructors tested the participants on key topics at the beginning and end of each workshop, allowing them to quantify their increased knowledge.

**TABLE 4: PARTICIPATION AND LEARNING DURING THE WORKSHOPS**

Workshop	Entities Represented	Number of Participants Day 1	Number of Participants Day 2	Grade Before	Grade After	Improvement
LULUCF	20	54	33	47%	71%	+61%
Energy	19	39	32	57%	78%	+37%
Agriculture	14	32	29	64%	83%	+30%
Industrial Processes	16	25	N/A	47%	78%	+66%
Waste	15	34	31	52%	75%	+44%

### 3.2 CHALLENGES, OPPORTUNITIES, AND NEXT STEPS FOR PRIORITY SECTORS

To achieve national GHG inventories in the priority sectors in Guatemala—inventories that comply with the principles established in the methodological guidelines of IPCC and are a solid component of the BUR 2014—the instructors developed group discussions to identify challenges, opportunities, and next steps.

Several lessons learned and opportunities arose from the workshops:

- Successful strategies:

- Filling gaps in basic GHG inventory knowledge was key.
- Interaction of actors of different types allows problem solving in situations of medium complexity.
- Clarification of the process of inventories' development and roles of stakeholders reduces barriers.
- Practical exercises reinforce knowledge and promote constructive discussion.
- Organization and punctuality are key to a successful event.
- Areas for improvement:
  - Present topics and objectives of training beyond the formal aspects.
  - Summarize reference materials for workshops and their characteristics, in addition to assigning them prior to the workshops.
  - List problems at the beginning rather than at the end of the workshop (given the limited available time and breadth of topics).
  - Involve all entities directly or indirectly participating in the development of inventories in the various sectors.
  - Assess needs identified in the evaluations.

The remainder of this section summarizes the key messages that emerged from each sectoral workshop; the challenges that participants and instructors identified jointly through group work; and the recommendations of the instructors and experts in inventories, which arose from the information shared at the workshop.

### 3.2.1 LULUCF

#### I. Challenges (Group Work):

- Accessing financial resources
- Securing cooperation between sectors so they provide the required information
- Generating information and improving the quality of available data
- Strengthening the institutions linked to the generation of information
- Knowledge of the importance of inventories
- Coordination capacity of the governing body in the integration of inventories
- Managing international cooperation
- Public-private partnerships
- Need for more extensive training and technical capacity building for GHG bookkeeping in the sector, particularly in:
  - the methodology for capturing and analyzing information;
  - topics of remote sensing;



- analysis of forestry inventory; and
- Geographic Information Systems (GIS).

## 2. **Opportunities:**

- There is a critical mass of young technicians who are motivated by the subject, interested in continuing to work, and willing to coordinate across sectors.
- There is an enabling international environment to support capacity building and mitigation in the LULUCF sector (including REDD+).

## 3. **Recommendations and next steps:**

- Further evaluate mitigation potential for LEDS with respect to the baseline in LULUCF in:
  - increased carbon pools;
  - preventing reservoirs in forests to reduce deforestation or degradation;
  - reducing emissions of the activity (e.g., fossil energy use); and
  - replacement of wood by cement and biomass by oil, among others.
- Analyze the adoption of new tools: the Statistics Division of the FAO (FAOSTAT) and Collect Earth of the FAO to represent systematic changes in land use.
- Adopt 2003 IPCC's Best Practice Guidance.
- Develop a continuous improvement plan (focusing on activity data and emission factors of key categories).
- Build institutional capacities and integrate coherently the preparation of inventories (integrate BURs and National Communications with LEDS, REDD+ and NAMAs).
- Leverage the significant progress in studies to reduce deforestation in some areas in Guatemala, particularly the preparation document for REDD+, the Readiness Preparation Proposal (R-PP) for the Forest Carbon Partnership Facility (FCPF) of the World Bank and the United Nations (UN)-REDD. These studies involve entities such as the National Council of Protected Areas (CONAP, "Consejo Nacional de Áreas Protegidas" in Spanish); the National Forestry Institute (INAB, "Instituto Nacional de Bosques" in Spanish); and the Rainforest Alliance for deforestation in the lowlands of the North and improvements in satellite monitoring systems for use and land-use change by universities, INAB, the Ministry of Agriculture, Livestock, and Food (MAGA, "Ministerio de Agricultura, Ganadería y Alimentación" in Spanish), etc.
- Focus on the national GHG inventories 2010 (review 1990, 2000, and 2005). Consider sending the first BUR as soon as possible.
- Develop/enhance the formal institutional arrangements to meet the above needs and strengthen leadership.
- For future inventories, detailed descriptions of the following items are recommended:
  - The calculation methodologies to increase transparency
  - The information sources used, including description of assumptions and statistical analysis
  - The calculations including emission factors and other parameters used

- Categories that are not reported and the justification for not reporting them

### 3.2.2 Energy

#### 1. **Challenges (Group Work):**

- Deeper and more specific training in procedural and technical aspects of GHG inventories
- Formally integrating information providers into the process of developing national GHG inventories
- On-the-job training in the initial stages of developing inventories
- Integrating information systems
- Promoting the committed participation of organizations and institutions
- Promoting contact of some actors with government areas or units involved
- Legislation or regulations that create emission reductions and rationally regulate GHG emissions reporting
- Formally identifying roles and actors for developing the national GHG inventories
- Promoting a virtuous circle of information flow for construction of the national GHG inventories
- Identifying special situations and supporting actors or establishing mechanisms to supplement MARN

#### 2. **Opportunities:**

- There is a positive and prone environment for collaboration between actors in the Energy Sector.
- There are some sources of useful data, but their original function was not for climate change or environmental purposes (e.g., vehicles database of the tax authority, SAT, “Superintendencia de Administración Tributaria” in Spanish).
- There is adequate technical capacity to manage the GHG inventory in the Energy Sector in Guatemala.
- The participation of universities and research institutes will enhance the development and maintenance efforts of the Energy Sector GHG inventory.
- The emerging oil and gas sector in Guatemala can be an example of establishing reporting systems for estimating emissions from the beginning.

#### 3. **Recommendations and next steps:**

- **Development of specialized human resources**

For the Energy Sector, this may be necessary at the sub-sector level and particularly in the entities that have to provide information. Staff turnover also has been a recurring problem.

The quality of consultancy work undertaken to date can be considered good given the nature of the information collection and infrastructure available.

Exposure to real situations presented during inventory development, strengthening of some specific topics, and coaching during the initial work could be more beneficial to strengthen the confidence and analytical skills to apply the criteria and methodologies that are more appropriate to a specific case.

- **Improved information systems and data collection**

The participants' main concern is the poor quality or inadequate breakdown of data for developing national GHG inventories for the Energy Sector.

In particular, information is lacking in key categories such as transportation, where the estimate or report of the various fuels used may be of low certainty. In the absence of data of distances and cargo transported by vehicle type, the Tier I approach is the only option for estimation of CO<sub>2</sub> emissions. This approach is not recommended.

Another important source of uncertainty is biomass used as domestic fuel, which affects non-CO<sub>2</sub> emissions. Currently there are only consumption estimates based on indirect data analysis of vegetation cover.

In both cases, as well as other subsectors for which there are insufficient data (burning natural gas, charcoal production, etc.), it is necessary to develop studies and methods for collecting and reporting information to give greater certainty to the GHG emissions inventory in the Energy Sector.

The key actors in the different subsectors expressed positive attitudes toward such activities, which the instructors found encouraging.

- **Strengthening the institutional and regulatory framework**

Some of the challenges in the Energy Sector arise because specific responsibility for each of the actors in the development of national GHG inventories has not been assigned (beyond the overall responsibility of MARN).

In such a scenario, there is no positive or negative incentive to establish or improve systems for collecting, gathering, and processing information and data. These actions require resources; therefore, they translate into additional costs for the different GHG data-generating entities involved in the Energy Sector.

- **Communication and cultural change**

Some of the observed situations arise due to a lack of communication about objectives, tools, goals, and needs for developing GHG inventories, which create information islands in which the information may be generated but not requested, or may be requested but not generated.

This situation is also closely related to the current institutional and regulatory framework mentioned in the previous point.

The point of cultural change is critical. Other countries have experienced challenges in terms of how to discriminate between different sources and how to collaborate in establishing the best source for collection of information to avoid partial or full redundancies. Guatemala's experience with forestry information systems is encouraging, because it shows that a cultural change is possible in the country.

### 3.2.3 Agriculture

#### 1. Challenges (Group Work):

Regarding data and institutional arrangements:

- Improve the quality of statistical information to provide the necessary activity data for inventories. Quality improvement relates to aspects such as availability in time and type, reliability, and level of disaggregation.
- Continue training in order to strengthen capacity to use methodologies for inventories.
- Improve coordination between institutions that deal with the Agriculture Sector (generating data, research, policy).

Regarding mitigation actions:

- Improve the quality of the diet of domestic animals and adapt animal stock per unit area.
- Produce organic fertilizer to replace chemical fertilizers.
- Harness methane as an energy source.
- Develop case studies of mitigation actions to serve as examples.
- Invest in technology and/or research through the National Council for Science and Technology (CONCYT, “Consejo Nacional de Ciencia y Tecnología” in Spanish).
- Invest at the government level in improving genetics.

#### 2. Opportunities:

- Critical mass of young technicians who are motivated by the subject, interested in continuing to work, and willing to coordinate across sectors
- Strengthening a multipurpose statistical information system for the Agriculture Sector, which can be of use for inventories, mitigation, and rural development policies
- Capabilities in universities and other institutes and nongovernmental organizations (NGOs) to develop research on relevant topics such as specific emission factors in Guatemala, and development of best practices for applying fertilizers to reduce N<sub>2</sub>O emissions, among others

#### 3. Recommendations and next steps:

- Institutional recommendations:
  - Designate a technical and institutional team responsible for the Agriculture Sector GHG inventory. The team leader would be responsible for coordinating the flow of information as well as the communication among providers of statistical information and technical staff responsible for compiling the information, analyzing data, and performing calculations for each source category.
  - Identify the office, agency, or government department designated as focal point to FAO for regular delivery of national statistics – thus ensuring that the used activity data comes from the same source.
  - Clearly define the times, responsibilities, and commitments of each activity, institution, and participant. It is recommended that the staff assigned to the Ministries (MAGA and MARN)

- assume coordination and establish written and formal mechanisms to collaborate among themselves and with other government entities providing information (Instituto Nacional de Estadística Guatemala [INE], INAB, CONAP), as well as academic institutions and independent consultants who provide technical support for the inventory.
- Dedicate full-time staff or at least limit their work to developing the inventory at set times for preparation responsibilities. In the event of not having enough staff, hire technical specialists through academic institutions or independent consultants who trained staff within the ministries properly supervise. Thus, the lessons learned during the process will remain with the technical staff of government agencies.
  - Limit the technical involvement of international cooperation agencies, academic institutions, and/or independent consultants so that their participation focuses on technical support. It is essential that government institutions take ownership of the process through participation and decision-making, supported by technical expertise from international aid agencies, research centers, and specialists in the field.
  - Establish mechanisms for cooperation and collaboration with the institution or person responsible for the overall coordination of Guatemala's National Inventory of GHG Emissions (MARN) for properly integrating the sector results in the Final Report. In this regard, the role of the LEDS-link staff or "enlace LEDS", funded by USAID, should be strengthened and gradually absorbed into the civil service to ensure proper coordination between the various institutions that are involved in both Agriculture and LULUCF.
  - It is recommended to maintain separate groups dedicated to the Agriculture and the LULUCF sectors due to the different nature of the types of information used for the inventory of each category.
- General technical recommendations:
- The Agriculture Sector appears to be the greatest contributor to global emissions in Guatemala, which seems to justify this sector's prioritization in future improvement plans and resource allocation. A special effort in institutional coordination is also justified, as it involves several institutions such as MAGA, MARN, and INE.
  - Develop a roadmap or work plan with specific goals, targets, schedules, and responsibilities; based on IPCC methodologies and guidelines established by the UNFCCC for National GHG Emissions Inventory as part of the BUR.
  - List categories and activities identified in the IPCC methodological guidelines for the elaboration of National GHG Emissions Inventory, and identify those that apply to the country. The 1996 IPCC methodological guidelines set out six categories and nearly 30 activities (the number of eligible activities depends on each country).
  - Identify the information or activity data necessary for making calculations in categories and corresponding activities. Continuously consult the 1996 IPCC methodological guidelines and the 2000 IPCC GPG. The methodologies and emission factors from the 2006 IPCC guidelines can be used when they are justifiably more appropriate to the country. All materials that the Task Force on National GHG Inventories (TFI) of the IPCC published are available at [www.ipcc-nggip.iges.or.jp](http://www.ipcc-nggip.iges.or.jp).
  - Focus on obtaining activity data that allows for establishing sets of unique and robust data for the farmland and livestock subsectors, as well as reliable time series. In most of the

calculations, default emission factors set out in the IPCC guidelines can be used. A query to the IPCC Emission Factors' database indicates that there have been no specific emission factors for the sector in Guatemala. The absence of this knowledge should not be construed as an insurmountable barrier – the review of national inventories of various countries has led to the conclusion that the essence of an inventory is the activity data, for which there are no default values.

- Take advantage of the technical support of international cooperation agencies. Make specific requests for information in different fora and with the right people. The IPCC TFI responds in a timely manner and appropriately to requests for information. Similarly, the group GEI Agricultura, established by the FAO in 2013 ([agricultura\\_GEI@dggroups.org](mailto:agricultura_GEI@dggroups.org)), brings together Latin American specialists in the field, answering specific technical questions from participants.
- Contrast results and calculations with those issued by the FAOSTAT emissions calculator ([faostat.fao.org](http://faostat.fao.org)). It is important to remember that the results may disagree for the following reasons: (i) the system uses the 2006 IPCC methodology; and (ii) in the absence of activity data, the system uses its own estimates. This technological resource does not replace the technical capacity of countries in developing emission inventories; rather, it allows nations to use a reliable tool to compare and contrast their results. It is important to note that the instructors downloaded the FAOSTAT tool for inventories and found significant differences between emissions reported by Guatemala in Agriculture and the FAOSTAT estimations using Tier I emission factors. This finding could indicate an overestimation of emissions in the highest ranked sector in terms of emissions in Guatemala. The authors recommend further analysis of these differences to correct or confirm the values reported in the Inventory.
- Reserve a portion of the budget for an evaluation of quality control of the Inventory. One option is hiring academic specialists in the field to independently review the inventory and verify compliance with the principles established by the IPCC.

### 3.2.4 Industrial Processes

#### 1. **Challenges (Group Work):**

- Communication between actors in the Industrial Processes Sector and dependencies
- Definition of levels and types of information for integration in the National GHG Inventory
- Formal establishment of a work process for developing the National GHG Inventory
- Coordination between various actors
- Attention to confidentiality of information provided by companies or industries
- Creation of formal discussions between government and industry to establish better mechanisms for information exchange
- Continuous capacity building

#### 2. **Opportunities:**

- Technical capacity exists in businesses as well as public and private research institutions for the proper development of GHG inventories, which only requires support and training on specific topics.
- Participation of chambers, industrial associations, and institutes can overcome obstacles that the disclosure of sensitive industry information presents; this participation can be key in communication and data provision.

#### 3. **Recommendations and next steps:**

##### – **Development of specialized human resources**

For the Industrial Processes Sector, this action may be necessary within certain industries or regions, as emission estimation methodologies can be very different. Combining dissimilar training needs in a single workshop particularly in specific aspects of the methodology can result in some participants assimilating the information poorly or being discouraged.

Although professionals in the industry have adequate capacity, this capacity focuses on design, operation, and maintenance of production facilities, as well as on environmental management imposed by social responsibility and legal systems. Therefore, reinforcement and capacity building for estimating and reporting GHG emissions is needed.

Exposure to real situations presented during inventory development, strengthening of some specific topics, and coaching during the initial work could be more beneficial to strengthen the confidence and analytical skills needed to apply the criteria and methodologies that are more appropriate to a specific case. This approach can be achieved with different levels of support depending on the actors and functions involved, from consulting to full-time support in the initial stages of reporting GHG emissions.

##### – **Improved information systems and data collection**

Most actors do not understand climate change policies and thus do not know how to meet government objectives and their obligations under these policies, which creates uncertainty.

A process for information flow should be clearly specified, in addition to procedures and roles in the development of the National Inventory of GHG Emissions, including alternate routes and references to key documents.

The best strategy for this purpose must be carefully analyzed to minimize the cost of implementation and management.

– **Strengthening the institutional and regulatory framework**

Some of the challenges in the sector arise because specific responsibility for each actor in the development of national GHG inventories has not been assigned (beyond the overall responsibility of MARN).

In such a scenario, there is no positive or negative incentive to establish or improve systems for collecting, gathering, and processing information and data, as this work requires resources and therefore translates into additional costs for the different GHG data-generating entities involved in the Industrial Processes Sector.

### 3.2.5 Waste

#### 1. **Challenges (Group Work):**

- Participation of more direct operators or municipalities
- Following up on this type of training
- Better mechanisms for internal capacity building
- Coordination with other industry players
- Commitment to and dissemination of climate change policy
- Identification and development of data collection systems
- Characterization of non-household effluents before entering wastewater treatment plants (WWTP)
- Dealing with commitments that Guatemala made to the UNFCCC
- Need for complementary data on clandestine operations

#### 2. **Opportunities:**

- There is a positive and collaboration-prone environment among industry actors in the Waste Sector
- Participation of NGOs and universities to complete the matrix of activity data and emission factors can be key, given that they have the skills and experience needed locally
- Given the nature of the sector, synergies can be created by sharing information between entities with greater capacity and those with less capacity



### 3. Recommendations and next steps:

#### – Development of specialized human resources

For the Waste Sector, this work may be necessary at the level of local authorities, particularly in organizations that operate or control sites that should provide information.

Although professionals in the fields of solid waste and wastewater have adequate capacity, this capacity focuses on design and operation. Building and strengthening capacity for estimating and reporting GHG emissions is necessary.

It is important to group strengthening and capacity building for actors with similar needs and functions, since shared problems can be developed in more detail in more specialized events.

Exposure to real situations presented during inventory development, strengthening of some specific topics, and coaching during the initial work could be more beneficial to strengthen confidence and analytical skills to apply criteria and methodologies that are more appropriate for a specific case. This work can be achieved with different levels of support depending on the actors and functions involved, from consulting to full-time support in the initial experiences of reporting GHG emissions.

#### – Improved information systems and data collection

Participants who are responsible for the operation or control of landfills or WWPT continuously voiced concerns regarding the lack of data for planning in the sector, including national GHG inventories of the Waste Sector.

In particular, there is a lack of information on unauthorized landfills and on the characteristics of industrial discharges to urban drainage systems installations. In some regions these situations represent the majority of operations; not knowing the characteristics of most of the operations in the country compromises inventory accuracy.

In both cases it is necessary to develop studies and methods for collecting and reporting information to give greater certainty to the inventory of GHG emissions in the Waste Sector.

#### – Strengthening the institutional and regulatory framework

Some of the challenges in this sector arise because specific responsibility for each actor in the development of national GHG inventories has not been assigned (beyond the overall responsibility of MARN).

In such a scenario, there is no positive or negative incentive to establish or improve systems for collecting, gathering, and processing information and data, as this work requires resources and therefore translates to additional costs for the different GHG data-generating entities involved in the Waste Sector.

## 4.0 RECOMMENDATIONS: ROADMAP

The national GHG inventories documents are dynamic in nature because of the mobility of the elements that influence them.

When inventories are sufficiently reliable, and are updated regularly, they become ideal tools for GHG management strategies and programs. This is because the information they provide is useful not only to establish baselines, but also to monitor and control the performance of such programs and strategies.

The GHG inventory report presents complex and high-uncertainty situations if all sectors, actors, and stakeholders are not involved in all stages, from identifying information needs to preparing the GHG inventory final report.

Given the nature of implementation of a LEDS and its upcoming implementation in Guatemala, it is important that the national GHG inventories be useful for planning and monitoring – provided that they have information that represents reality. To constitute a valid GHG management tool, the inventories must be developed based on information, methodologies, and data that are reliable and representative of the environment in which they are prepared.

### 4.1 KEY MESSAGES

The following are key messages for achieving national GHG emissions inventories that meet UNFCCC requirements and IPCC methodological guidelines and are a solid component of LEDS policies and actions and the BUR.

- I. **Develop a participatory National GHG Inventory System.** The only way the effort to develop national GHG inventories will be sustainable, even if financial resources are available to maintain a permanent working group, is through the participation of different sectors in different stages of the inventory process.

In particular, there are subsectors that have all the technical expertise and equipment to make their own GHG inventories, which with capacity building in methodologies and reporting can produce reports that become direct inputs for the National GHG Inventory.

In this manner, MARN's UCC would play the role of compiler, coordinator, and reviewer of the National GHG Inventory, handling aspects of calculation and estimation only in special situations or in support of subsectors with little or no human or financial capacity to carry out the process. The latter also could be entrusted to institutions of higher education or research.

Success for this effort is the participation of as many stakeholders with a minimum intervention (and cost) to MARN and adequate reliability of the inputs and outputs. To have the greatest success, it is necessary to establish or strengthen the communication channels between key representatives of the sectors—such as those that represent key categories—approaching them to define their training and support needs as well as the most efficient methods for working together.

The Industrial Processes Sector is a paradigmatic case in which interrupted communication and mistrust is apparent. For this case, the necessary bridges must be rebuilt to enable a participatory spirit. By the nature of this sector, operations are varied even between companies with similar products, and there is high specificity of the processes. Therefore, it is essential that these actors be the ones developing their own estimates.

2. **Build effective and sustainable institutional arrangements.** Based on the above, it seems essential to identify and build effective and sustainable institutional arrangements and transition from the previous temporary and aperiodic arrangements to continuous work processes involving permanent national technical teams.

In the case of Guatemala a model that decentralizes tasks by sector and inventories connected with sectoral mitigation policies seems preferable. In this context, MARN would have the key role of compiling, coordinating, and ensuring methodological consistency in the inventories. In turn, each ministry or institution involved would provide their corresponding sectoral inventory to MARN, including activity data, emission factors, and calculation methodology. MARN would then carry out a quality check. At the same time, MARN would act as focal point to the UNFCCC and would liaise with the sources of funding and technical assistance to ensure that the ministries and sectoral institutes are able to implement REDD+, NAMAs, and LEDS policies. This model is in line with MARN's vision of creating strong internal capabilities in addition to building capacity for its primary role as compiler, coordinator, and reviewer.

This model requires strengthening both MARN and the sectoral entities working under the coordination of MARN. The new and more demanding scenarios require updating the inventory every two years (BUR) and are subject to external review processes (ICA), in addition to submitting National Communications every four years. This context suggests that providing government institutions with the skills needed to prepare the sector inventories and compile the National GHG Inventory is desirable. Internalizing the inventories' process within government institutions will allow Guatemala to continuously improve their quality and use the same criteria in every cycle. It is a medium- and long-term process with few immediate results. However, it is the most promising course for Guatemala, also because inventory capabilities are the basis for formulating LEDS, REDD+, and NAMAs.

The key tasks that MARN might consider taking on, depending on national circumstances, would be:

- a) Lead, plan, and coordinate actions with government and, where appropriate, nongovernment officials
- b) Identify all institutions and teams that should be involved and contribute to the preparation of National Communications and BUR, including the establishment of formal arrangements
- c) Assign responsibilities to institutional actors
- d) Develop and monitor the work schedule, including relevant milestones for delivery of products
- e) Identify constraints and gaps in technical, information, and financing capabilities
- f) Implement MRV systems
- g) Manage funding for the preparation of reports to ease constraints and distribute it among the institutions of the system
- h) Compile all sections of the national communication and BUR in a document

- i) Maintain the archive of all relevant information about the process and ensure institutional memory, including all data, assumptions, and methods used
- j) Periodically evaluate the process and draw lessons for continuous improvement

3. **Build stable technical capabilities within ministries and other government agencies already working in GHG inventories and aim to develop a National GHG Inventory System in Guatemala.** Within the suggested model, it is important that MARN have the capacity to lead and manage the entire process, as well as control the quality of the inputs it receives from the sectoral institutions, i.e., technical capacity and ability to maintain a dialogue with all responsible institutions. It is necessary to strengthen the capacities of the contributors of data and form data-generation chains, including their ability to prepare the inventories independently of MARN, limiting MARN's involvement in sector inventories to receiving and validating a product.

As part of additional work to strengthen the ministries and other public entities, it may be beneficial to continue the integration of the LEDS-link consultants who have been hired within ministries and key institutions, supported by FCMC. It would be important to empower them, prioritize their tasks, and strengthen their skills so they can function in more practical ways in developing activities, inventory calculations, and leadership in public policy issues. Further training is essential, for example through internships in countries like Mexico, where the National Institute of Ecology and Climate Change ("Instituto Nacional de Ecología y Cambio Climático" in Spanish) is responsible for the inventory. This work would be consistent with the interests of USAID in Mexico to contribute to the exchange between Mexico and Guatemala, as well as with other underway USAID initiatives to which these trainings could link. USAID, in turn, could commit to continuing to fund the consultants, as long as the local counterparts commit to integrating these consultants within ministries and other entities in a relatively short time.

4. **Prioritize the strengthening of information.** In addition to strengthening the technical skills needed to develop inventories, it is imperative to put in place processes to improve the statistical data available in key sectors of the inventory where weaknesses have been identified. Inventories are a tool for the public and private sectors to make policy decisions. These decisions require information systems and adequate data quality.

Some categories or subsectors do not have complete or reliable activity data. A similar problem exists with respect to national emission factors, and the government has prioritized their development or validation. Improving quality of information is also critical given that Guatemala's LEDS program is initiating. The accuracy of the GHG inventory is key to proper planning and validation of the impact of mitigation actions, not only for the BURs but also as the basis for a LEDS program.

It is advisable in this new phase to prioritize activity data, which are essential for domestic MRV. Inventories are instantaneous photographs of a dynamic reality in which the annual activity data generally changes the most (for example, the number of cattle, hectares planted, deforested land area, wood consumption, fossil-fuel consumption, industrial production, waste generated, etc.). The emission factors, however, tend to be more stable. If there are no national values, one can temporarily use the default IPCC factors, especially for non-critical categories. In other words, the development of MRV actions is largely associated with activity data, and MRV is a key element of LEDS, NAMAs, and REDD+.

Based on this information, Guatemala would need to properly prioritize at the sector, sub-sector, or individual levels to identify the emission factors to be developed for Guatemala (starting with those applicable to the key categories) as an alternative to the IPCC default factors. For example, in certain subsectors of the Industrial Processes and Waste Sectors, emission factors that do not

reflect the reality of the country are being used. By contrast, because of the nature of Agriculture and LULUCF, there are generally compatible emission factors data that can be used. In this case, only emission factors data that have not been validated will need to be validated.

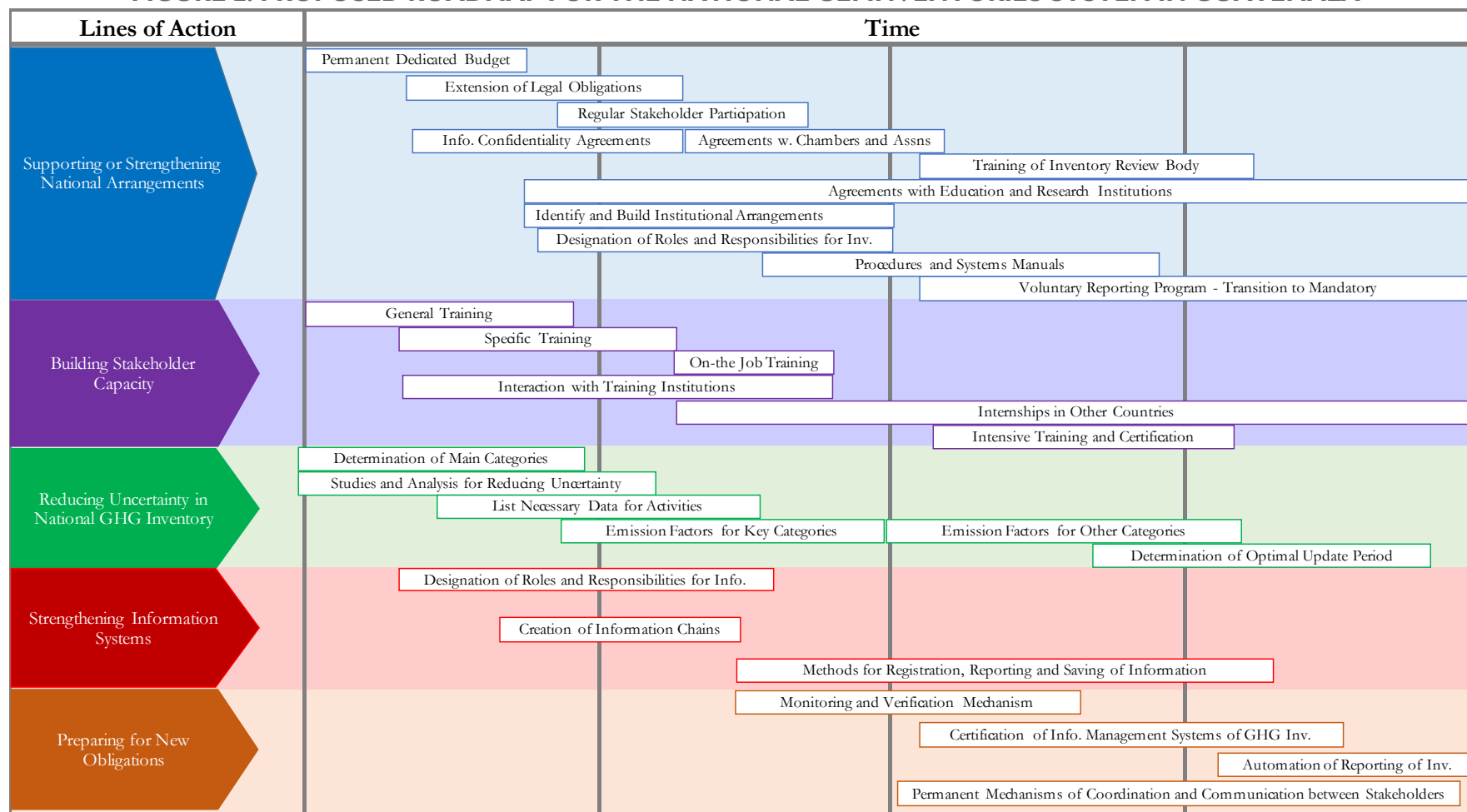
In addition, Guatemala could take advantage of opportunities such as the FAO project for Monitoring and Assessment of Greenhouse Gas Emissions and Mitigation Potential in Agriculture (MAGHG). MAGHG works with countries in defining the gaps, challenges, and opportunities to improve agricultural and rural statistics through tools such as FAOSTAT. FAOSTAT is a database with data sources such as FAO, the International Labor Organization (ILO), and the World Bank for more than 200 countries. Based on this database, the FAO is developing tools for GHG inventories to compare the emission data that countries report against default estimates. It is possible that if Guatemala voices interest, it could receive support from the FAO to diagnose its statistical system and prepare a plan to improve the system.

5. **Prioritize the completion and submission of the first BUR (for example during the first quarter of 2015) based on the 2010 inventory.** It would be highly advantageous for Guatemala to be among the countries that send their first BUR in late 2014 and early 2015, and therefore be a part of the ICA process of the UNFCCC. The ICA begins operating in 2015 to analyze inventories of non-Annex I countries and provide recommendations for continuous improvement. Eventually, Guatemala could consider providing its BUR along with the Second National Communication, or delivering this communication later if the delay in the BUR jeopardizes its entrance in the first round of the ICA process.
6. **Common aspects with LEDS.** The analysis, effort, training, and vision that have been used in this series of workshops is fully consistent with the vision of LEDS. Thus, it would be appropriate to reconsider some of the points made in this report and, if required, reinforce some of them to give continuity to the support that is ending with this consultancy. Several of the recommendations and key messages are applicable for LEDS and can serve as an additional input for planning and developing activities, particularly in the initial stages.

## 4.2 ROADMAP

To address the above key messages, Figure 2 below presents a suggested roadmap. Activities in development or resulting from the implementation of LEDS that could be part of this general emissions management roadmap are not included, since the focus of these workshops was the national and sectoral GHG inventories. The remainder of this section describes the roadmap in more detail.

**FIGURE 2: PROPOSED ROADMAP FOR THE NATIONAL GEI INVENTORIES SYSTEM IN GUATEMALA**



## Supporting or Strengthening National Arrangements

The National GHG Inventory in any country, including Guatemala, depends on the articulation of various strata, sectors, and actors of society, including those in the public, private, and international aid sectors. Thus, the priority is to finalize national arrangements to pave the way for a transition from the current situation to the desirable one in which the GoG—through MARN’s UCC—receives, processes, and compiles information. MARN would be in charge of GHG reporting, minimizing its role in generating activity data, emission factors, and emission estimates except for conversions, verification, and observations in the validation and verification of national GHG inventories.

In Guatemala there has been progress in this direction, as seen in the establishment of agreements and interagency communication to share general information, including information concerning construction of the national GHG inventories.

The national arrangements that could be implemented or modified follow:

- **Permanent dedicated budget:** Secure financial and human resources for the development of National GHG Inventories in Guatemala by including them as line items in the public budgets. Institutions such as the Global Environment Facility support countries to achieve their National Communications and BUR. It is important that these resources are managed and flow to the partner institutions for GHG inventories, resisting the temptation to use them entirely to maintain the capabilities of the coordinating unit (MARN). In many countries in Latin America, this is a real problem that prevents the strengthening of the broader framework of inventory development.
- **Extension of legal obligations:** Extend legal obligations to provide information and participate in the preparation of GHG inventories to other relevant government agencies beyond MARN.
- **Regular stakeholder participation:** Establish regular channels of participation of stakeholders (NGOs, sector chambers, associations, etc.) in the development, reviewing, or verification of the National GHG Inventory.
- **Information Confidentiality Agreements:** Establish confidentiality agreements and conceal shared information for the purposes of inventories, either specifically for the inventories or by modifying the current regulations that apply to INE to include the information provided for inventories.
- **Agreements with chambers and associations:** Given the experience in other countries, and in the event that this option is viable and acceptable for the stakeholders, establish collaboration agreements with chambers, unions, and associations, among others, to provide information to the compiler of the National GHG Inventory on a consolidated basis, to the minimum acceptable level of disaggregation, thus protecting identity and specific data. These data would be available if necessary, protected under applicable concealing and confidentiality agreements.
- **Training of inventory review body:** Establish an advisory board or a similarly qualified body to review the quality of the GHG inventory, independent of the bodies involved in the preparation. Alternatively, establish partial agreements with institutions or specialists in Guatemala or abroad for external reviews and quality assurance.
- **Agreements with education and research institutions:** Establish partnerships with educational and research institutions or consultants to develop studies and analysis aimed at capacity building and reducing uncertainty of National GHG Inventories.

- **Identify and build institutional arrangements:** Consider the best location and characteristics of the team developing National GHG Inventories to ensure independence and optimal communication with different actors with experiences from other countries. Construct the necessary institutional arrangements for implementation.
- **Designation of roles and responsibilities for GHG inventories:** Designate roles and responsibilities in the process of developing sectoral GHG inventories, including activity data, emission factors, and calculation methodology, as well as compiling and reviewing their quality.
- **Procedures and systems manuals:** Establish procedures manuals for GHG inventory preparation, including the roles of the various actors and the required qualifications and standards to follow, collection and calculation formats, reporting formats, rules and criteria for applying procedures, as well as user and recipient feedback for the inventory.
- **Voluntary reporting program – transition to mandatory:** Establish voluntary reporting programs for productive and service entities prior to legal obligation.

## Building Stakeholder Capacity

This idea was widely discussed in the workshops, which resulted from a diagnosis established prior to the workshops. The main points to be noted, considering the principle of “training with sense”<sup>11</sup> follow:

- **General training:** General training for involved actors regarding climate change and GHG inventories
- **Specific training:** Specific training for entities or individuals in charge of generating activity data, emission factors, or emission calculation in the different sectors
- **On-the job training:** On-the job training for participants during the first iteration of preparing GHG inventories
- **Interaction with training institutions:** Interaction with interested institutions so that they become national trainers
- **Internships in other countries:** Internships abroad for the technical staff in the institutions and entities responsible for developing National GHG Inventories
- **Intensive training and certification:** Intensive training and certification of staff in charge of national reports and of reviewing and verifying inventories

## Reducing Uncertainty in National GHG Inventory

The information used in the development of National GHG Inventories in some cases is less than ideal because of the lack of national information and the less-than-optimal treatment of activity data and emission factors.

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<sup>11</sup> Refers to training only on necessary topics and only for those who need it, minimizing resources and the time needed to do implement the training.



The action lines that can be proposed to improve this situation and thus reduce uncertainty in the National GHG Inventory follow:

- **Determination of main categories:** Analyze uncertainty using the best activity data and emission factors available to determine the main categories.
- **Studies and analysis for reducing uncertainty:** Commission analyses or studies to establish procedures to improve the quality of the activity data in the main categories, including the estimation of activities not currently accounted for (wood burning, illegal landfills, etc.).
- **List necessary data for activities:** List all activity data needed to report the main categories; diagnose quality, quantity, and timeliness of the information available; and develop an improvement plan in coordination with partner institutions.
- **Emission factors for key categories:** Generate specific emission factors for all major categories by:
  - validating emission factors so that they are appropriate for Guatemala; and
  - developing emission factors for Guatemala through engineering analysis, measurements, or other high-reliability methods.
- **Emission factors for other categories:** Generate reliable emission factors for the rest of the categories (low priority).
- **Determination of optimal update period:** Determine optimal period or milestones to require updating activity data or emission factors.

## Strengthening Information Systems

Strengthening statistical systems in Guatemala is key to the quality of inventories as well as LEDS, NAMAs, and REDD+ policies including MRV. But this work can only be done in agreement with “partner” institutions (INE, INAB, MAGA, etc.) jointly devising multi-objective improvement plans (that is, not just for inventories) and obtaining public and international cooperation resources. The FAO (through MAGHG) is relevant as a source of technical support to diagnose and develop a plan to improve the quality and quantity of information.

The information necessary to build National GHG Inventories originates from several sources. As a result, it seems necessary to consider the characteristics and context of those who generate information when establishing mechanisms to achieve greater reliability and meet the objectives of programs established in the future.

Some activities with high social impact could benefit greatly from the participation of universities and colleges given their high credibility and ongoing programs involving communities.

There are some situations that require prompt attention; this observation has been expressed in various fora and in various ways by MARN. The main lines of action follow:

- **Designation of roles and responsibilities for information:** Designate roles and responsibilities in the process of generating and collecting information to develop the National GHG Inventory.
- **Creation of information chains:** Information chains should be created by subsector or activity, avoiding interference from external actors in the process of generating data.

- **Methods for registration, reporting, and saving information:** Establish methods for recording, reporting, and storing information for the different levels and stages of development of the inventory, in compliance with national and international reporting provisions undertaken by the GoG.

## Preparing for New Obligations

As a non-Annex I country, Guatemala has increasingly stringent obligations, including more frequent reports with a broader scope (BUR), which must include the national inventories and the results of undertaken mitigation activities, among other information.

Similarly, the mandatory review mechanism for Annex I countries (ICA) for National Communications and BUR, is likely to be extended to non-Annex I countries and includes a detailed review of the methodology and reporting of National GHG Inventories. This extension also implies that countries will need to constantly update and manage the National GHG Inventory.

The key issues to address in this context are:

- **Monitoring and verification mechanism:** Establishment of mechanisms for monitoring and verifying National GHG Inventory, including a plan for quality assurance and control
- **Certification of information management systems for GHG inventories:** Certification of systems for collecting, processing, and storing information
- **Automation of reporting of inventories:** Automation of reporting of inventories, considering platforms for restricted use for input data
- **Permanent mechanisms of coordination and communication between stakeholders:** Establishment of communication programs and events, and continuous and permanent coordination with sector decision-makers or key actors involved in the development of National GHG Inventories

As mentioned before, there are barriers, primarily related to financial resources, to make the development of the GHG inventory a sustained activity over time. There are also barriers such as a lack of information and a lack of trust between actors.

Nevertheless, the upcoming implementation of LEDS and actions the country has taken, particularly in the LULUCF sector, are encouraging especially if available resources of international institutions are leveraged for the initial stages of capacity building and systems implementation.

The elements that could be part of a roadmap outlined in the preceding paragraphs encompass the opinions and comments collected directly from participants in the events and discussions with various bodies, existing public documentation about the situation of National GHG Inventories in Guatemala, and the experience of experts involved in different stages of these workshops. Therefore, the roadmap is not a mandatory course of action, but rather an opinion on the available evidence, which must be contrasted with the vision of the actors as well as with various broader and specific analyses of the anticipated situation in the country.

It must be recognized that Guatemala has advanced in the preparation of National GHG Inventories, incorporating the recommended IPCC methodology in the National Communications essentially on its own. Therefore, it has demonstrated that the capacity exists and that in many cases only certain complementary aspects must be strengthened.

Similarly, there are national arrangements that may not have been denoted as such and that have allowed these achievements. These arrangements should thus remain the basis for additional or complementary arrangements; keeping, with special criteria and mechanisms, those arrangements which by their nature or sensitivity are required to move forward in building a sound National GHG Inventories System.

# APPENDIX I. REPORTS FOR THE WORKSHOPS TO SUPPORT GUATEMALA'S NATIONAL GREENHOUSE GAS INVENTORIES

Opening	FCMC. (June 2014). Opening Workshop to Support Guatemala's National Greenhouse Gas Inventories.
LULUCF	FCMC. (July 2014). Workshop to Support Guatemala's National Greenhouse Gas Inventories in the Land Use and Land-Use Change and Forestry Sector (LULUCF).
Energy	CNCG. (August 2014). Workshop to Support Guatemala's National Greenhouse Gas Inventories in the Energy Sector.
Agriculture	FCMC. (September 2014). Workshop to Support Guatemala's National Greenhouse Gas Inventories in the Agriculture Sector.
Industrial Processes	CNCG. (November 2014). Workshop to Support Guatemala's National Greenhouse Gas Inventories in the Industrial Processes Sector.
Waste	CNCG. (October 2014). Workshop to Support Guatemala's National Greenhouse Gas Inventories in the Waste Sector.
Closing	FCMC. (November 2015). Closing to Support Guatemala's National Greenhouse Gas Inventories within LEDS.

# APPENDIX 2. BIOGRAPHIES OF THE INSTRUCTORS

## **Dr. Benjamin Caldwell**

Dr. Caldwell has more than 10 years of work experience in ecology forestry management, REDD+, forestry agriculture, and sustainable development. He was the technical lead for the Kasigau Corridor in the Kenya project and the Choco Darien projects in Colombia, both of which were flagship projects under the Verified Carbon Standard.

He was one of the main authors for the REDD+ Methodology for the Verified Carbon Standard to Avoid Deforestation (VM0009). He is the principal inspector/auditor of the Forestry Protocol under the carbon forestry offset compliance standard of the California Air Resources Board.

Dr. Caldwell worked for two years in Paraguay on agroforestry and agricultural intensification. His doctoral thesis focused on measuring and monitoring systems of roots in forests. Currently he technically and administratively leads global natural resource projects, with an emphasis on projects that include climate change mitigation and adaptation components.

He has a PhD in environmental, political, and administrative studies and a master of forestry science from the University of California at Berkeley. He has an undergraduate degree in environmental studies from Eckerd College in Florida.

## **Francisco Luis Aviña Cervantes**

Francisco Luis Aviña Cervantes graduated from the National Autonomous University of Mexico with a degree in biology. He has postgraduate studies and experience with research in biological environments. Professionally, he has had technical and administrative roles in institutions like the Research and Advanced Studies Center at National Polytechnical University (CINVESTAV-IPN) and the Institute of Ecology, A.C. (INECOL). He was a consultant for the United Nations Development Programme (UNDP) in the Fifth National Symposium on Climate Change in Mexico. In 2012 he joined the INECC, where he was a reviewer for the agricultural category for the updating of the 2010 National Inventory of GHG Emissions. He participated in international workshops organized by the FAO (2013-2014) on GHG emissions inventories for the agricultural sector, where Mexico participated as a pilot project in an international program for institutional capacity building. Currently he is the Head of the Department of Inventory and Future GHG Emissions for the Agricultural Sector under the General Coordination of Climate Change and Low Carbon Development (CGCCDBC), where he coordinates the updating of the Agricultural National GHG Inventories in Mexico as part of the BUR 2014 under the UNFCCC.

## **Ignacio Barutta**

Mr. Barutta has more than 11 years of professional experience and more than nine years specifically dedicated to the development of projects related to global climate change mitigation. He is an environmental engineer with a degree from the Catholic University of Argentina. He has held senior positions working with leading multinational companies. His work primarily has been dedicated to the development and management of projects in diverse regions around the globe.

He has training and experience as an environmental consultant at the local and international levels. His professional experience includes topics such as the management of GHG emissions, GHG inventories, carbon footprint analysis for the lifecycle of products, identification and development of GHG emission reduction projects (Clean Development Mechanism [CDM] and voluntary), inventory and control of atmospheric emissions, environmental impact assessments, environmental due diligence, site investigation and remediation (soil and groundwater), municipal solid waste, health and safety, and legal compliance of environmental aspects. He has held teaching positions in various institutions and conducts training for different sectors in terms of emissions management and climate change mitigation.

Mr. Barutta is the co-author of methodology approved by the UNFCCC, AM0063, and has participated in the development of various methodologies also approved and in development for CDM-registered projects primarily in the energy and industrial sectors. Currently he is working as an auditor in the verification and validation of emissions reduction projects under the CDM and voluntary programs. He also has worked on developing GHG emissions inventories along with identifying mitigation opportunities across countries and sectors.

### **Jorge Alberto Plauchú**

Mr. Plauchú is a graduate of electro-mechanical engineering from the National Autonomous University of Mexico (1981) with a specialization in turbo-machinery design (through the ABB-ETH program born from the partnership between the multinational ABB and the Swiss Federal Institute of Technology [ETH] in Zurich, Switzerland, 1983). He has a master's in business administration (MBA) from the University Michoacana of San Nicholas of Hidalgo, Mexico (2006). He is a master's candidate on climate change from the University of Europe, Miguel de Cervantes in Spain (2014). Additionally, he holds a professional certificate in energy efficiency (ATPAE, "Asociación de Técnicos y Profesionistas en Ahorro de Energía" in Spanish—now defunct, 2001) and vapor systems (Armstrong Industries, Michigan, 2002) and has held operational and management positions in manufacturing, energy, engineering, and consulting businesses before becoming an independent consultant of energy and climate change (1994).

He has carried out and collaborated on the development of more than 360 studies, analyses, plans, strategies, and policies related to energy efficiency and climate change for governments at every level; businesses and organizations in the agricultural, manufacturing, commercial, institutional, and independent consultant sectors; and for international initiatives in 24 countries across America, Asia, and Europe, with more than 3,800 trained professionals. He has given more than 90 lectures at various forums. Currently he is a consultant for the U.S. Environmental Protection Agency (EPA), U.S. Department of State, USAID, Environment Canada, the World Bank, and the Inter-American Development Bank (IDB).

His experience with GHG includes audits, inventories, and proposals of emission mitigation methods related to the production and use of energy, CDM, and NAMA projects. He authored various standard documents and coauthored two books on energy efficiency and the methodology AM0063 of the UNFCCC. He has collaborated on the Climate Action Plan of the City of Mexico and served as a reviewer of the technical guide for calculating the Accounting Standard and Corporate Value Chain Report (Scope 3) of the GHG protocol.

### **Julia Martínez**

Ms. Martínez is a biologist with more than 21 years of experience in climate change at the National Institute of Ecology (now the National Institute of Ecology and Climate Change). During this time she coordinated the development of five National Communications that the Government of Mexico presented to the UNFCCC. She has concentrated her work on the coordination of GHG emissions inventories for Mexico (1990-2010); options for mitigation and evaluations of the vulnerability and

adaptation options for climate change; and on the dissemination and public awareness of the information generated.

Ms. Martinez coordinated the training—including the development of methodologies appropriate for the reality of the country—of the 32 states of Mexico to prepare their State Action Programs on Climate Change. She also worked with the Local Governments for Sustainability Mexico Office in developing Municipal Climate Action Programs.

Ms. Martinez graduated from the National Autonomous University of Mexico and has a specialization from Beth Israel Hospital in New York.

### **Mark Oven**

Mr. Mark Oven has more than 30 years of experience in the energy and environmental sectors, with a particular focus on energy efficiency, clean energy, and mitigation of GHG. His focus has been on energy end uses in the industrial and commercial sectors. His experience focuses on three areas: implementation of energy and environmental technologies projects; training of technicians and engineers in these subjects; and development and preparation of government policies on promoting energy efficiency and reduced environmental impacts.

Mr. Oven has lived and worked in more than 25 countries, focusing on development projects and improving local capacities in the energy and environment sectors. He currently serves as the Director of Tetra Tech in Arlington, Virginia.

Mr. Oven is a graduate of Santa Clara University in California, and holds a master's degree in Mechanical Engineering from Cornell University in New York.

### **Walter Oyhantçabal**

Mr. Walter Oyhantçabal is an agronomist with 15 years of experience in agriculture and climate change. He was negotiator in forest issues for the CDM of the Kyoto Protocol between 2000 and 2004 and in 2010. He joined the Working Group for methodologies of forestry projects in the CDM Executive Board from 2004 to 2011. He worked as the lead author for the Fourth IPCC Report 2007 (Chapter Mitigation Forests). He is the lead reviewer of GHG inventories and National Communications and a specialist in the LULUCF Sector for the UNFCCC. In this capacity, he has reviewed more than 26 inventories and communications. In 2014 he reviewed Chile's GHG Forestry inventory and the Brazil baseline for REDD+ in the Amazon.

He compiles the Uruguayan GHG inventory, specifically in charge of Agriculture and LULUCF sectors. He has coordinated technical teams to prepare a study to estimate the carbon footprint of beef, rice, and dairy meat. He is currently coordinating a project for the Adaptation Fund in Uruguay, is the counterpart of a study on low carbon economy with the World Bank, and is participating in a Green Economy study.

Mr. Oyhantçabal has a master of science in Agricultural Engineering from the Faculty of Agronomy of Uruguay. He has a degree in Environmental Management and earned a Master in Environmental Sciences at the Faculty of Sciences of Uruguay.

# APPENDIX 3. SOURCES FOR THE WORKSHOPS

General	<p>IPCC. (1996). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.</p> <p>IPCC. (2000). Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories.</p> <p>CMNUCC. (2005). Handbook: Managing the greenhouse gas inventory process.</p> <p>CMNUCC. (2008). Resource guide for preparing the National Communications of Non-Annex I Parties. Module 3: National Greenhouse Inventories.</p> <p>CMNUCC. (2013). “Toolkit for non-Annex I Parties on establishing and maintaining institutional arrangements for preparing National Communications and biennial update reports”,</p> <p>CMNUCC. (2000, 2002, 2011). Relevant COP Decisions (Annex III, 17/CP.8; 2/CP.17).</p> <p>Tetra Tech. (2013). “Institutional Assessment and Sector Analysis for the Low-Emissions Development Strategy in Guatemala.” USAID.</p> <p>Rainforest Alliance. (2013). “New Project will Contribute to Mitigating Effects of Climate Change in Guatemala”.</p> <p>USAID. “FCMC Program brochure”. <a href="http://lowemissionsasia.org/resource/forest-carbon-markets-and-communities-fcmc-program-brochure#sthash.UY3c2xS8.dpuf">http://lowemissionsasia.org/resource/forest-carbon-markets-and-communities-fcmc-program-brochure#sthash.UY3c2xS8.dpuf</a>.</p>
LULUCF	<p>IPCC. (1996) Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 5.</p> <p>IPCC. (2000). Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Chapters 6 and 8.</p> <p>IPCC. (2003). Good Practice Guidance for Land Use, Land-Use Change and Forestry. Chapters 1, 2, 3, and Appendix 3A1.</p>
Energy	<p>IPCC. (1996). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Chapters 1, 2-1, and 3-1.</p> <p>IPCC. (2000). Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000. Chapter 2.</p>
Agriculture	<p>IPCC. (1996) Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Chapter 4.</p> <p>IPCC. (2000). Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Chapter 4.</p>
Industrial Processes	<p>IPCC. (1996). Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Chapters 1, 2-2, and 3-2.</p>



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